

REMARKS

35 U.S.C. § 103

In the Office action dated June 10, 2009, the Examiner rejected claims 1-3 and 9-14 under 35 U.S.C. 103(a) as being unpatentable over Nakao (US 5,882,827) in view of Smith (Attenuated phase shift mask materials for 248 and 193 nm lithography, J. Vac. Sci. Technol. B, vol. 14, no. 6, pp 3719-3722) and further in view of Kashida (US 5,326,649).

Claim 1

The Examiner states:

4. Nakao teaches a mask comprising a mask substrate (1) a half tone mask material (3) arranged in a pattern across the mask substrate (1) and a light-blocking layer (5) arranged in a pattern across the half tone layer (3).

5. Nakao does not teach that the half tone layer comprises silicon nitride.

6. Smith teaches the composition of a half tone mask, in a range of amorphous silicon to stoichiometric silicon nitride, i.e., said composition being a silicon rich silicon nitride, SiN(X) where $0 \leq X \leq 1$.

...

10. Nakao in view of Smith does not teach that the silicon nitride comprises hydrogen.

11. Kashida teaches a silicon nitride layer for use in a mask wherein said silicon nitride layer comprises hydrogen and has a transmission of 70% (column 2 lines 40-50).

12. It would have been obvious to one of ordinary skill in the art to incorporate hydrogen into the layer because this will permit the use of CVD which is a rapid deposition method.

The Examiner acknowledges that Nakao and Smith do not teach that the silicon nitride comprises hydrogen and relies on Kashida to allegedly teach this feature. The Examiner cites Col. 2, lines 40-50 in support of the allegation. Applicant disagrees. The cited portion of Kashida describes the formation of a silicon nitride membrane from compounds such as SiH₄, Si₂H₆ and NH₃ where the content of hydrogen does not exceed 1.0 atomic %. In contrast, claim 1 recites "the half-tone mask material is silicon-rich silicon nitride SiN_x:H with x in the range 0 to 1," where the atomic percentage of H depends on the value of x. For example, when

$x=1$, there is approximately one hydrogen atom for every pair of Si and N atom and therefore the atomic percentage of hydrogen is approximately 33.33. On the other hand when x is almost 0, the atomic percentage of hydrogen is almost 50. For other values of x , the atomic percentage of hydrogen lies within these two values. For at least the above reason, Applicant contends that Kashida fails to describe or suggest the foregoing feature of claim 1. Rather, Kashida states¹:

As is described above, the most characteristic feature of the inventive X-ray transmitting membrane of silicon nitride consists in the extremely low content of hydrogen atoms not exceeding 1.0 atomic % and such a silicon nitride membrane of low hydrogen content can be obtained only by the CVD method carried out under the above described very specific conditions.

Kashida aims to reduce the amount of hydrogen in the silicon nitride membrane and is therefore understood to be teaching away from the feature “the half-tone mask material is silicon-rich silicon nitride $\text{SiN}_x\text{:H}$ with x in the range 0 to 1.”

Applicant submits that Nakao, Smith and Kashida, alone or in combination, fail to disclose or teach each and every feature of amended independent claim 1 at least for the foregoing reasons and claim 1 is therefore patentable over the cited references.

All of the dependent claims are patentable for at least the reasons for which the claims on which they depend are patentable.

Canceled claims have been canceled without prejudice or disclaimer.

Any circumstance in which the applicant has addressed certain comments of the examiner does not mean that the applicant concedes other comments of the examiner. Any circumstance in which the applicant has made arguments for the patentability of some claims does not mean that there are not other good reasons for patentability of those claims and other claims. Any circumstance in which the applicant has amended or canceled a claim does not mean that the applicant concedes any of the examiner's positions with respect to that claim or other claims.

No fees are believed to be due. Please apply any charges or credits to deposit account 06-1050.

¹ Kashida, Col. 2, line 66 – Col. 3, line 4.

Applicant : French, et al.
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Respectfully submitted,

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/Rex I. Huang/_____
Rex I. Huang
Reg. No. 57,661

Fish & Richardson P.C.
225 Franklin Street
Boston, MA 02110
Telephone: (617) 542-5070
Facsimile: (877) 769-7945

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